PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-319740
(43)Date of publication of application : 24.11.1999

(51)Int.Cl. B08B 5/00

(21)Application number : 10-130408
(22)Date of filing : 13.05.1998

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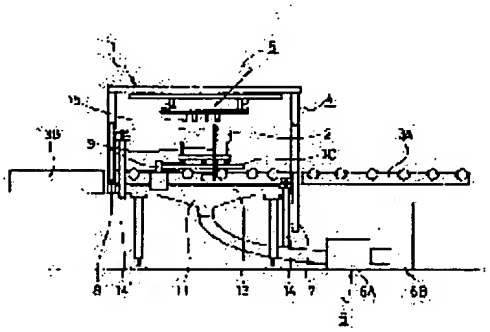
(54) DUST REMOVAL DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To remove efficiently dust of a small particle size stuck to an assembly body by a method wherein air of a specific pressure is intermittently jetted to the assembly body from an air nozzle, and dust flying up in the air from the assembly body by the air-jetting is sucked.
SOLUTION: An air jetting means 5 is fixed above a dust removal chamber 4, six lines of air nozzles 15 as one set for four nozzles, are provided to the air jetting means 5, and air of a higher pressure than a positive pressure is jetted to an assembly body 2 from those air nozzles 15. Dust stuck to a surface of the assembly body 2 is allowed to fly up in the air by the jetting, and a large dust of at least 20 μm in particle size having been allowed to fly up is removed through a suction duct 11 by a sucking means 6. Then, the dust included in the removed air is removed by an attracting electrostatic filter 6B, and the clean air is discharged to the outside.



LEGAL STATUS

[Date of request for examination]	11.09.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3501343
[Date of registration]	12.12.2003
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The dust stripper equipped with an Ayr injection means to inject Ayr of a predetermined pressure from an air jet hole intermittently to said assembly in order to blow away the dust adhering to an assembly, and a suction means to attract the dust danced in the air from said assembly by the Ayr injection.
[Claim 2] Said suction means is a dust stripper according to claim 1 characterized by preparing suction opening of said suction means under said assembly in order to attract the dust which floats to the relaxation time of said Ayr injection.
[Claim 3] The dust removal room isolated in said assembly to a perimeter in order to remove the dust adhering to said assembly, The door for carrying in opened and closed when carrying in said assembly to said dust removal room, A dust stripper [equipped with the door for taking out opened and closed when taking out said assembly from said dust removal room, and carrying-in / taking-out means for carrying in and taking out said assembly at said dust removal room] according to claim 1 or 2.
[Claim 4] The dust stripper according to claim 3 characterized by having an open air inhalation means to introduce the purified exterior air and to maintain said dust removal room to positive pressure.
[Claim 5] Said Ayr injection means is a dust stripper according to claim 1 or 2 characterized by weakening the adhesion force of the dust which was made to neutralize the dust adhering to said assembly electrically, and adhered to said assembly by injecting ionized Ayr to said assembly.
[Claim 6] Said suction means is a dust stripper according to claim 1 or 2 characterized by attracting said dust only to the relaxation time of said Ayr injection.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the dust stripper for removing the dust adhering to the precision mechanical equipment as an assembly.
[0002]
[Description of the Prior Art] As an assembly (for example, like manufacture and the erector of a precision mechanical equipment), in order to raise the reliability of a finished product, and the engine performance, the dust with a particle size of 20 micrometers or more which set like manufacture and an erector and adhered to the assembly is removed from the former. For example, CCD of high resolution is used for the lens unit 21 of the reading section 20 roughly shown in drawing 3 in precision optical instruments, such as a copying machine. When dust had adhered to the movable mirror 22 of this reading section 20 and a manuscript is read, image formation of the dust with a particle size of 20 micrometers or more adhering to the movable mirror 22 is carried out to 1-dimensional Rhine CCD of the lens unit 21, muscle-like stripes occur in a duplication, and there is a problem that manuscript reading quality deteriorates. Therefore, before equipping with the contact glass which omits illustration like the erector of the reading section 20, in order to remove the dust adhering to the movable mirror 22 and the lens unit 21 While blowing away the dust which injected Ayr of a constant pressure continuously on the front face of the movable mirror 22, and the front face of the objective lens of the lens unit 21, and adhered to the movable mirror 22 and the lens unit 21 He attracts the dust danced in the air, and is trying to remove dust as much as possible from an assembly.
[0003]
[Problem(s) to be Solved by the Invention] By the way, in order to aim at much more improvement in reading precision recently, the demand which also removes a thing with a particle size of less than 20 micrometers as much as possible is increasing. However, there is un-arranging [which less than 20-micrometer dust cannot ride the flow of the air by the suction means easily in the dust removal by the conventional Ayr continuation injection, it is not easily attracted by the suction means since it will be in the condition ride on the eddy (turbulent flow) of the air which the dust danced in the air produces by the Ayr injection, and float the air of the assembly upper part, but particle size falls toward an assembly again, and adheres].
[0004] This invention was made in view of the above-mentioned situation, and aims at offering the dust stripper which can remove efficiently the dust with a small particle size adhering to an assembly.
[0005]
[Means for Solving the Problem] In order to blow away the dust with which the dust stripper of claim 1 adhered to the assembly in order to attain this purpose, it has an Ayr injection means to inject Ayr of a predetermined pressure from an air jet hole intermittently to said assembly, and a suction means to attract the dust danced in the air from said assembly by the Ayr injection.
[0006] In the dust stripper of claim 1, the dust stripper of claim 2 is characterized by preparing suction opening of said suction means under said assembly, in order to attract the dust which floats for said suction means at the relaxation time of said Ayr injection.

[0007] The dust stripper of claim 3 is set to a dust stripper according to claim 1 or 2. The dust removal room isolated in said assembly to a perimeter in order to remove the dust adhering to said assembly, It has the door for carrying in opened and closed when carrying in said assembly to said dust removal room, the door for taking out which are opened and closed when taking out said assembly from said dust removal room, and carrying-in / taking-out means for carrying in and taking out said assembly at said dust removal room.
[0008] The dust stripper of claim 4 is characterized by having an open air inhalation means to introduce the purified exterior air and to maintain said dust removal room to positive pressure in a dust stripper according to claim 3.
[0009] In a dust stripper according to claim 1 or 2, by injecting Ayr where said Ayr injection means was ionized to said assembly, the dust stripper of claim 5 neutralizes the dust adhering to said assembly electrically, and is characterized by weakening the adhesion force of the dust adhering to said assembly.
[0010] The dust stripper of claim 6 is characterized by said suction means attracting said dust only to the relaxation time of said Ayr injection in a dust stripper according to claim 1 or 2.
[0011] Since it decided to turn Ayr to an assembly intermittently and to inject it according to invention according to claim 1 to 6, the condition that there is no turbulence of the air produced by the Ayr injection can be repeated to the Ayr injection relaxation time, and it can be made to generate, therefore it will put on the flow of the air by the suction means, and dust can be attracted.
[0012]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing.
[0013] For 1, in drawing 1 and drawing 2 , a dust stripper body and 2 are [the conveyor for conveyance as a carrying-in / taking-out means of an assembly and 3C of an assembly, and 3A and 3B] pallets. Here, through a predetermined process, the assembly **** assembly 2 is put on pallet 3C, and is carried toward the dust stripper body 1 by conveyor 3A for conveyance. The suction means 6 for attracting the dust danced in the dust removal room 4, an Ayr injection means 5 to inject Ayr of a predetermined pressure, and the dust removal room 4 as shown in the dust stripper body 1 at drawing 2 is established.
[0014] The suction duct 11 which leads to the door 7 for carrying in, the door 8 for taking out, the carrying-in object detector 9, the open air inhalation means 10, and the suction means 6 is formed in this dust removal room 4. This door 7 for carrying in and the door 8 for taking out are opened and closed by the cylinder 14 for door closing motion, and 14'.
[0015] The open air inhalation means 10 is installed in the side of the dust removal room 4. This open air inhalation means 10 is equipped with the electrostatic filter 12, the open air is sent into the dust removal room 4 from open air inhalation opening which omits illustration by the fan for open air inhalation, and dust is removed by the electrostatic filter 12 in that case. By installation of this open air, the dust removal room 4 is maintained at a pressure [a little] higher than an outside atmospheric pressure, i.e., positive pressure, and even if it does not make the dust removal room 4 into an airtight structure, external dust can maintain it at the condition of not trespassing upon the dust removal room 4.
[0016] As for the suction duct 11, it is caudad prepared in the dust removal room 4. It is opened for free passage by the suction means 6, this suction duct 11 being used as the trumpet configuration which goes caudad and by which the diameter of the opening area of suction opening was reduced. The suction means 6 has motor 6A for suction, and electrostatic filter 6B for suction. In order to prevent turbulence of the air at the time of suction near the suction duct 11, the straightening vane 13 is formed.
[0017] The flow of fixed air is made in the dust removal room 4 by the inflow of the air by the open air inhalation means 10, and discharge of the air by the suction means 6. Removal of dust is performed by putting the dust which drifts the air with the flow of this air. Here, it is considering as the flow of the air of wind-speed (rate of flow) 1.2 m/s - 1.8 m/s.
[0018] In the dust removal room 4, the carrying-in object detector 9 the existence of a carrying-in object and for the check of a carrying-in location is formed. The door 7 for carrying in will be

closed if the assembly 2 having been carried in normally and having stood it still in the predetermined location is detected by the carrying-in object detector 9.

[0019] The Ayr injection means 5 is being fixed above the dust removal room 4. An air jet hole 15 makes four a lot here, and Ayr of a pressure higher than positive pressure is injected to an assembly 2 by this Ayr injection means 5 from 6 successive-installation eclipse ****** and this air jet hole 15. Io which abbreviates illustration to the Ayr injection means 5 -- NAIZA is prepared, by making + and - ionize Ayr injected, dust is neutralized electrically and the adhesion force of the dust adhering to the front face of an assembly 2, for example, the front face of the movable mirror 22, and the front face of the objective lens of the lens unit 21 is weakened. Here, Ayr of a pressure higher than the ionized positive pressure is injected from an air jet hole 15 to an assembly 2 by the 24m [a maximum of //s] rate of flow. This injection is intermittent, and in order to maintain positive pressure for the inside of the dust stripper 4 in cooperation with the open air inhalation means 10 at injection relaxation time, the 2m of the rates of flow/and about s Ayr are sent out from an air jet hole 15.

[0020] If Ayr of a pressure higher than positive pressure is injected by the assembly 2, the dust which adhered to the front face of an assembly 2 by this Ayr will have danced in the air. Since this Ayr is ionized, the dust adhering to the front face of an assembly 2 serves as neutrality electrically, and it becomes easy to separate it from the front face of an assembly 2. The time of generating of the eddy of the air according [comparatively big dust 20 micrometers or more] to the Ayr injection in the particle size danced in the air by this Ayr injection also rides the flow of the air by the suction means 6, and it is easy to sediment, and is removed by the suction means 6 through the suction duct 11 prepared in the lower part of the dust removal room 4. Although there is much what particle size rides on the eddy of the air which produces less than 20-micrometer dust by injection, floats, and does not descend easily, if the Ayr injection by the Ayr injection means 5 is stopped and the eddy of air is extinguished, the flow of the fixed air produced with the open air inhalation means 10 and the suction means 6 will be ridden, and it will pass along the suction duct 11, and will be recovered by the suction means 6. Then, next Ayr injection is performed.

[0021] Ayr containing the dust attracted through the suction duct 11 is removed in dust by electrostatic filter 6B for suction, and is discharged outside as pure Ayr.

[0022] After a dust removal activity is completed, the door 8 for discharge can open and an assembly 2 is carried like the next manufacture erector.

[0023] Drawing 4 illustrates the pressure variation (drawing 4 (b)) in the dust removal room 4 to the Ayr intermittent injection (drawing 4 (a)) by the Ayr injection means 5, and floating change (drawing 4 (c)) of the amount of dust with time. Here, the suction means 6 is drawing in continuously, as shown in drawing 4 (d). If the pressure in the dust removal room 4 repeats change between five atmospheric pressures and two atmospheric pressures by this injection, it is behind for a while from the early stages of the Ayr injection, the pressure of four dust removal increases and the Ayr injection is stopped as it is shown in drawing 4 (b), when Ayr injection of a pressure higher than positive pressure is performed intermittently, as shown in drawing 4 (a), a pressure will become weaker quickly. Moreover, if Ayr of a predetermined pressure is injected by the assembly 2, the dust adhering to an assembly 2 will have danced in the air. drawing 4 (c) is boiled by the with a predetermined pressure [first] Ayr injection, makes 100% the number of dust which is danced and raised in the air and floats, and the amount of suspended particles which changes with the repeats of the Ayr intermittent injection of a pressure higher than positive pressure is shown. In this drawing 4 (c), as for a continuous line, particle size shows the ratio of less than (for example, 10 micrometers) 20-micrometer dust, and, as for the broken line, particle size shows the ratio of dust 20 micrometers or more.

[0024] Since the dust adhering to the front face of an assembly 2 will have danced in the air if Ayr of a pressure higher than positive pressure is injected by the front face of an assembly 2 as shown in drawing 4 (c), if a little rate of dust suspension rises and the Ayr injection is stopped after that, the rate of dust suspension will change it to reduction by suction of the dust by the suction means 6. Since the eddy of the air by injection occurs, before the rate of dust suspension changes to reduction immediately after the Ayr injection, it will take time amount for

a while. Since the dust which sedimented on the front face of assembly 2 at the time of the next Ayr injection has danced in the air again, the rate of dust suspension rises, but since remarkable dust is attracted by the suction means 6 in the case of the 1st injection, the rate of increase decreases compared with the increment in the number of dust by the last injection. Thus, by repeating the Ayr intermittent injection of a pressure higher than positive pressure, the value of the rate of dust suspension decreases gradually, and the dust adhering to the front face of an assembly 2 is removed.

[0025] Compared with less than 20-micrometer dust, as for dust 20 micrometers or more, the rate of dust suspension decreases [particle size / particle size] by the Ayr intermittent injection of the small count of a repeat. It is because the dust with a big particle size tends to sediment compared with dust with a small particle size, and it is easy to ride the flow of the air by the suction means 6, so suction effectiveness becomes high.

[0026] By the conventional approach of injecting Ayr continuously, removal can remove efficiently dust with a difficult particle size of less than 20 micrometers by performing intermittently Ayr injection of a pressure higher than positive pressure so that clearly from this drawing 4 .

[0027] As mentioned above, although considered as the configuration which attracts Ayr in the dust removal room 4 continuously with the suction means 6 irrespective of under the Ayr injection and a pause with the operation gestalt of this invention, you may make it attract Ayr in the dust removal room 4 by the suction means 6 only during the pause of the Ayr injection.

[0028]

[Effect of the Invention] Since the dust stripper concerning this invention was made to make an assembly inject Ayr intermittently with the Ayr injection means as explained above By being able to put efficiently the dust danced in the air from the assembly on the flow of the air by the suction means, and repeating this intermittent Ayr injection In the conventional continuous Ayr injection, removal does so the effectiveness that removal of dust with a difficult particle size of less than 20 micrometers becomes easy.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of the dust stripper concerning this invention.
[Drawing 2] It is the side elevation of the dust stripper concerning this invention.
[Drawing 3] It is drawing showing an example of an assembly, and is the outline perspective view of the reading section which can be set like an erector.
[Drawing 4] It is drawing showing the relation between the dust removal internal pressure force over the intermittent injection of Ayr of a predetermined pressure, and the rate of dust removal house dust dust suspension.
[Description of Notations]
1 -- Dust stripper body
2 -- Assembly
4 -- Dust removal room
5 -- The Ayr injection means
6 -- Suction means
10 -- Open air inhalation means

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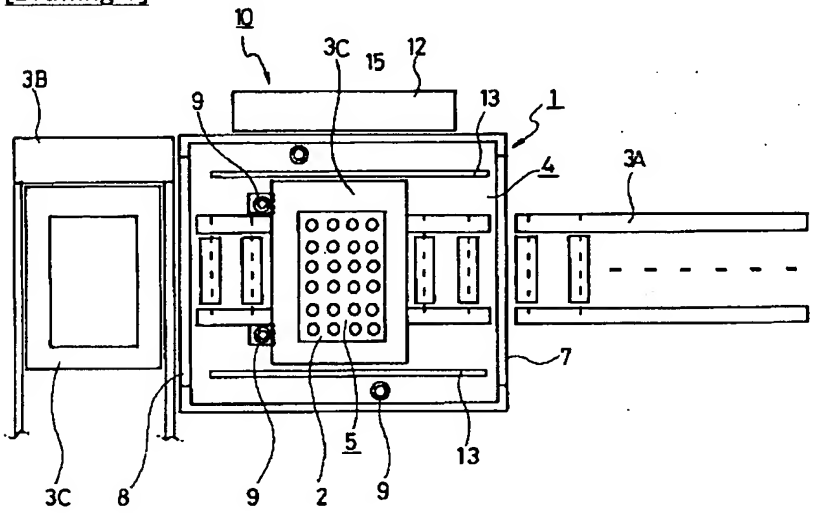
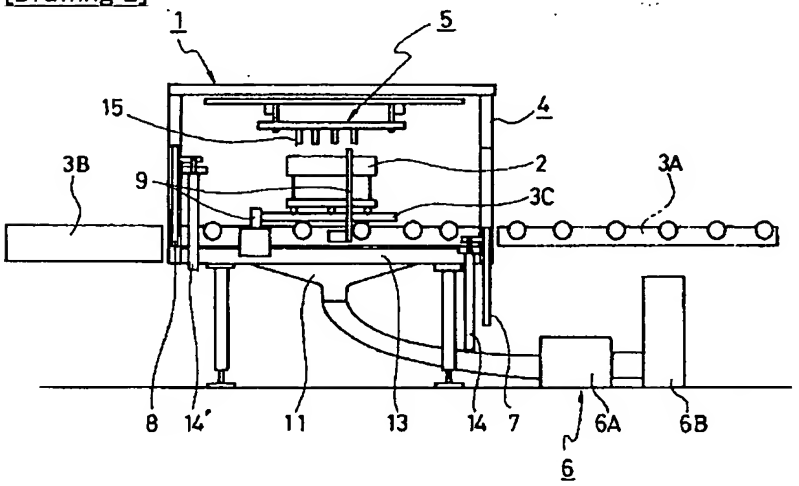
DRAWINGS

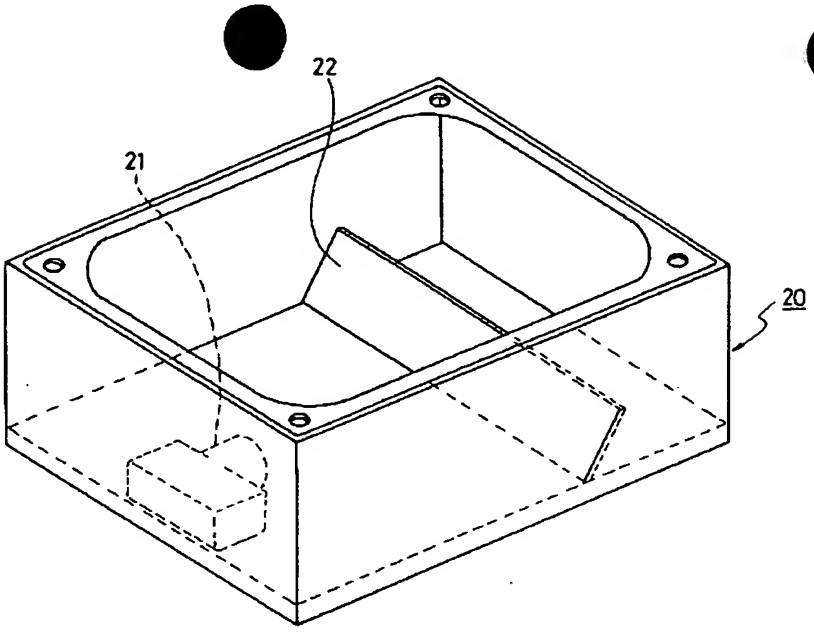
[Drawing 1]



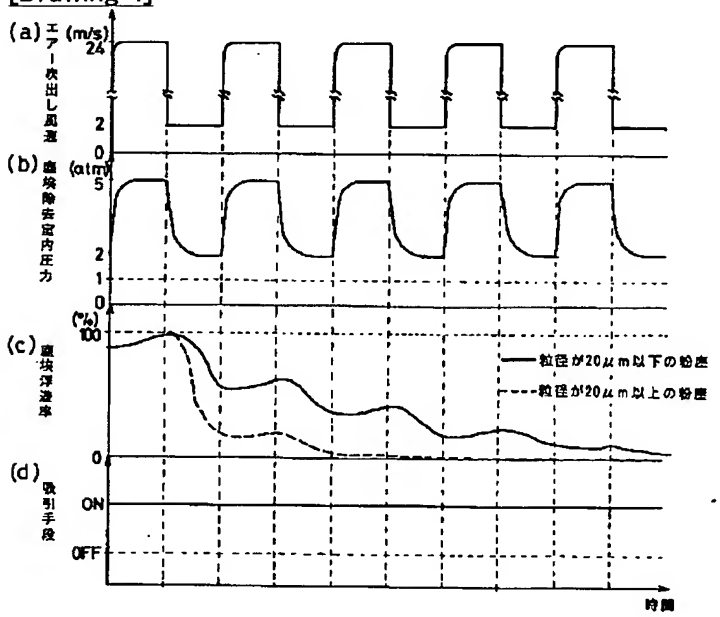
[Drawing 2]



[Drawing 3]



[Drawing 4]



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(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－319740

(43)公開日　平成11年(1999)11月24日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｂ０８Ｂ　5/00		Ｂ０８Ｂ　5/00	Ａ

審査請求　未請求　請求項の数6　ＯＬ　（全 6 頁）

(21)出願番号　特願平10－130408

(22)出願日　平成10年(1998)５月13日

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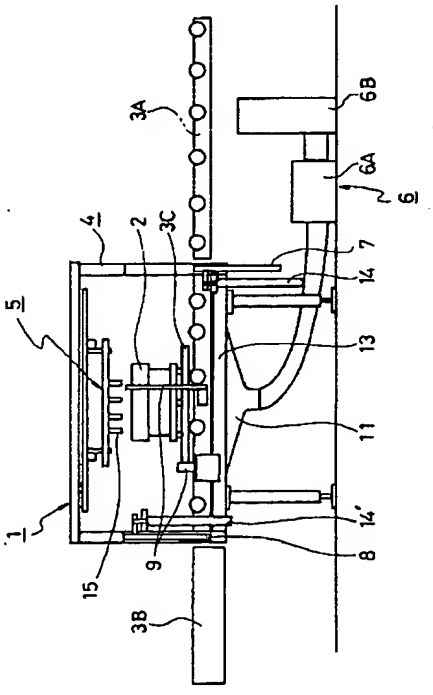
(54)【発明の名称】　塵埃除去装置

(57)【要約】

【課題】従来の連続的エアー噴射では除去が困難な２０μｍ未満の塵埃を容易に除去できる塵埃除去装置を提供する。

【解決手段】本願発明の塵埃除去装置１は、組立体２に付着した塵埃を吹き飛ばすために組立体２に対してエアーノズル１５から所定圧力のエアーを間欠的に噴射するエアー噴射手段５と、エアー噴射により組立体２から空中に舞い上げられた塵埃を吸引する吸引手段６とを備えている。



【特許請求の範囲】
【請求項１】組立体に付着した塵埃を吹き飛ばすために前記組立体に対してエアーノズルから所定圧力のエアーを間欠的に噴射するエアー噴射手段と、エアー噴射により前記組立体から空中に舞い上げられた塵埃を吸引する吸引手段とを備えた塵埃除去装置。
【請求項２】前記吸引手段は、前記エアー噴射の休止時に浮遊する塵埃を吸引するために、前記組立体の下方に前記吸引手段の吸引口が設けられていることを特徴とする請求項１に記載の塵埃除去装置。
【請求項３】前記組立体に付着した塵埃を除去するために周囲に対して前記組立体を隔絶する塵埃除去室と、前記組立体を前記塵埃除去室に搬入するときに開閉される搬入用扉と、前記組立体を前記塵埃除去室から搬出するときに開閉される搬出用扉と、前記組立体を前記塵埃除去室に搬入・搬出するための搬入・搬出手段とを備えている請求項１又は請求項２に記載の塵埃除去装置。
【請求項４】浄化された外部空気を導入して前記塵埃除去室を陽圧に維持する外気吸入手段を有することを特徴とする請求項３に記載の塵埃除去装置。
【請求項５】前記エアー噴射手段は、イオン化されたエアーを前記組立体に噴射することにより前記組立体に付着した塵埃を電気的に中和させ、前記組立体に付着した塵埃の付着力を弱めることを特徴とする請求項１又は請求項２に記載の塵埃除去装置。
【請求項６】前記吸引手段は前記エアー噴射の休止時にのみ前記塵埃を吸引することを特徴とする請求項１又は請求項２に記載の塵埃除去装置。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】この発明は、組立体としての例えば精密機器に付着した塵埃を除去するための塵埃除去装置に関するものである。
【０００２】
【従来の技術】従来から、組立体としての例えば精密機器の製造・組立工程では、完成品の信頼度、性能を高めるために、製造・組立工程において組立体に付着した２０μｍ以上の粒径の塵埃を除去している。例えば、複写機等の精密光学機器では、図３に概略的に示す読み取り部２０のレンズユニット２１に高解像度のＣＣＤが用いられている。この読み取り部２０の可動ミラー２２に塵埃が付着していると、原稿を読み取った際に、可動ミラー２２に付着した２０μｍ以上の粒径の塵埃がレンズユニット２１の１次元ラインＣＣＤに結像され、複写物に筋状の縞が発生し、原稿読み取り品質が低下するという問題がある。そのため、読み取り部２０の組立工程では、図示を略すコンタクトガラスを装着する前に、可動ミラー２２、レンズユニット２１に付着した塵埃を除去するために、一定圧力のエアーを連続的に可動ミラー２２の表面、レンズユニット２１の対物レンズの表面に噴射して、可動ミラー２２、レンズユニット２１に付着した塵埃を吹き飛ばすと共に、空中に舞い上げられた塵埃を吸引して、組立体から極力塵埃を取り除くようにしている。
【０００３】
【発明が解決しようとする課題】ところで、近時、読み取り精度のより一層の向上を図るために、２０μｍ未満の粒径のものも、極力除去するようにとの要求が高まりつつある。ところが、粒径が２０μｍ未満の塵埃は、従来のエアー連続噴射による塵埃除去では、吸引手段による空気の流れに乗りにくく、空中に舞い上げられた塵埃がエアー噴射によって生じる空気の渦（乱流）に乗って組立体上方の空中を浮遊する状態となるため、吸引手段によりなかなか吸引されず、再び組立体に向かって落下して付着する不都合がある。
【０００４】この発明は上記の事情に鑑みてなされたもので、組立体に付着している粒径の小さな塵埃を効率よく除去することのできる塵埃除去装置を提供することを目的とする。
【０００５】
【課題を解決するための手段】この目的を達成するため請求項１の塵埃除去装置は、組立体に付着した塵埃を吹き飛ばすために前記組立体に対してエアーノズルから所定圧力のエアーを間欠的に噴射するエアー噴射手段と、エアー噴射により前記組立体から空中に舞い上げられた塵埃を吸引する吸引手段とを備えている。
【０００６】請求項２の塵埃除去装置は、請求項１の塵埃除去装置において、前記吸引手段に前記エアー噴射の休止時に浮遊する塵埃を吸引するために、前記組立体の下方に前記吸引手段の吸引口が設けられていることを特徴とする。
【０００７】請求項３の塵埃除去装置は、請求項１又は請求項２に記載の塵埃除去装置において、前記組立体に付着した塵埃を除去するために周囲に対して前記組立体を隔絶する塵埃除去室と、前記組立体を前記塵埃除去室に搬入するときに開閉される搬入用扉と、前記組立体を前記塵埃除去室から搬出するときに開閉される搬出用扉と、前記組立体を前記塵埃除去室に搬入・搬出するための搬入・搬出手段とを備えている。
【０００８】請求項４の塵埃除去装置は、請求項３に記載の塵埃除去装置において、浄化された外部空気を導入して前記塵埃除去室を陽圧に維持する外気吸入手段を有することを特徴とする。
【０００９】請求項５の塵埃除去装置は、請求項１又は請求項２に記載の塵埃除去装置において、前記エアー噴射手段がイオン化されたエアーを前記組立体に噴射することにより前記組立体に付着した塵埃を電気的に中和させ、前記組立体に付着した塵埃の付着力を弱めることを特徴とする。
【００１０】請求項６の塵埃除去装置は、請求項１又は

請求項２に記載の塵埃除去装置において、前記吸引手段が前記エアー噴射の休止時にのみ前記塵埃を吸引することを特徴とする。

【００１１】請求項１～請求項６に記載の発明によれば、エアーを間欠的に組立体に向けて噴射することにしたので、エアー噴射によって生じる空気の乱れのない状態をエアー噴射休止時に繰り返し発生させることができることになり、従って、吸引手段による空気の流れに乗せて塵埃を吸引できることになる。

【００１２】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づいて説明する。

【００１３】図１及び図２において、１は塵埃除去装置本体、２は組立体、３Ａ，３Ｂは組立体の搬入・搬出手段としての搬送用コンベア、３Ｃはパレットである。ここでは、所定の工程を経て組立られた組立体２はパレット３Ｃに乗せられ、搬送用コンベア３Ａによって塵埃除去装置本体１に向かって運ばれる。塵埃除去装置本体１には、図２に示すように塵埃除去室４、所定圧力のエアーを噴射するエアー噴射手段５、塵埃除去室４内に舞い上げられた塵埃を吸引するための吸引手段６が設けられている。

【００１４】この塵埃除去室４には、搬入用扉７、搬出用扉８、搬入物検出器９、外気吸入手段１０、吸引手段６に通じる吸引ダクト１１が設けられている。この搬入用扉７及び搬出用扉８はドア開閉用シリンダ１４，１４’により開閉される。

【００１５】外気吸入手段１０は、塵埃除去室４の側方に設置されている。この外気吸入手段１０は静電フィルター１２を備え、外気は図示を略す外気吸入口から外気吸入用ファンにより塵埃除去室４に送り込まれ、その際に静電フィルタ１２により塵埃が除去される。この外気の導入により、塵埃除去室４は外気圧よりも若干高い圧力、すなわち陽圧に保たれ、塵埃除去室４を気密構造としなくとも外部の塵埃が塵埃除去室４に侵入しない状態に保つことができる。

【００１６】吸引ダクト１１は塵埃除去室４内の下方に設けられている。この吸引ダクト１１は、下方に向かって吸引口の開口面積が縮径されたラッパ形状とされて、吸引手段６に連通されている。吸引手段６は吸引用モーター６Ａと吸引用静電フィルター６Ｂとを有する。吸引ダクト１１の近傍には吸引時の空気の乱れを防ぐため、整流板１３が設けられている。

【００１７】外気吸入手段１０による空気の流入と吸引手段６による空気の排出とにより、塵埃除去室４内には一定の空気の流れが作られている。この空気の流れに空中を漂う塵埃を乗せることにより塵埃の除去が行われる。ここでは、風速（流速）１．２ｍ／ｓ～１．８ｍ／ｓの空気の流れとしている。

【００１８】塵埃除去室４内には、搬入物の有無，搬入位置の確認用の搬入物検出器９が設けられている。搬入用扉７は、組立体２が正常に搬入されて所定位置に静止されたことが搬入物検出器９により検出されると閉じられる。

【００１９】エアー噴射手段５は、塵埃除去室４の上方に固定されている。このエアー噴射手段５には、エアーノズル１５がここでは４本を一組として６列設けられており、このエアーノズル１５から陽圧よりも高い圧力のエアーが組立体２に対して噴射される。エアー噴射手段５には図示を略すイオナイザーが設けられており、噴射されるエアーを＋，－にイオン化させることにより塵埃を電気的に中和して、組立体２の表面、例えば、可動ミラー２２の表面、レンズユニット２１の対物レンズの表面に付着した塵埃の付着力を弱めている。ここでは、イオン化された陽圧よりも高い圧力のエアーがエアーノズル１５から組立体２に対して最大２４ｍ／ｓの流速で噴射される。この噴射は間欠的であり、噴射休止時には外気吸入手段１０と協力して塵埃除去装置４内を陽圧を維持するために、流速２ｍ／ｓ程度のエアーがエアーノズル１５から送り出される。

【００２０】陽圧よりも高い圧力のエアーが組立体２に噴射されると、このエアーにより組立体２の表面に付着した塵埃が空中に舞い上げられる。このエアーはイオン化されているため、組立体２の表面に付着している塵埃は電気的に中性となり、組立体２の表面から離れ易くなる。このエアー噴射により空中に舞い上げられた粒径が２０μｍ以上の比較的大きな塵埃は、エアー噴射による空気の渦の発生の際でも吸引手段６による空気の流れに乗って沈降しやすく、塵埃除去室４の下部に設けられた吸引ダクト１１を通って吸引手段６により除去される。粒径が２０μｍ未満の塵埃は噴射によって生じる空気の渦に乗って浮遊してなかなか降下しないものが多いが、エアー噴射手段５によるエアー噴射を休止して空気の渦が消滅すると、外気吸入手段１０と吸引手段６とにより生じる一定の空気の流れに乗って吸引ダクト１１を通り、吸引手段６によって回収される。続いて、次回のエアー噴射を行なう。

【００２１】吸引ダクト１１を通って吸引された塵埃を含んだエアーは、吸引用静電フィルター６Ｂにより塵埃を除去されて清浄なエアーとして外部に排出される。

【００２２】塵埃除去作業が終了すると排出用扉８が開けられ、組立体２は次の製造組立工程に運ばれる。

【００２３】図４はエアー噴射手段５によるエアー間欠噴射（図４（ａ））に対する塵埃除去室４内の圧力変化（図４（ｂ））及び浮遊する塵埃量の変化（図４（ｃ））を経時的に例示したものである。ここでは、吸引手段６は図４（ｄ）に示すように連続して吸引を行っている。陽圧よりも高い圧力のエアー噴射が図４（ａ）に示すように間欠的に行われると、図４（ｂ）に示すように、この噴射により塵埃除去室４内の圧力が５気圧か

ら２気圧の間で変化を繰り返し、エアー噴射初期から少し遅れて塵埃除去４室の圧力が高まり、エアー噴射を休止すると急速に圧力が弱まる。また、所定圧力のエアーが組立体２に噴射されると、組立体２に付着していた塵埃が空中に舞い上げられる。図４（ｃ）は一回目の所定圧力のエアー噴射によりに空中に舞い上げられて浮遊する塵埃数を１００％として、陽圧より高い圧力のエアー間欠噴射の繰り返しにより変化する浮遊塵埃量を示したものである。この図４（ｃ）において、実線は粒径が２０μｍ未満（例えば、１０μｍ）の塵埃の比率を示し、破線は粒径が２０μｍ以上の塵埃の比率を示している。

【００２４】図４（ｃ）に示すように、陽圧より高い圧力のエアーが組立体２の表面に噴射されると、組立体２の表面に付着している塵埃が空中に舞い上げられるため、塵埃浮遊率は少し上昇し、その後、エアー噴射を休止すると、吸引手段６による塵埃の吸引により塵埃浮遊率が減少に転ずる。エアー噴射直後は噴射による空気の渦が発生するため、塵埃浮遊率が減少に転じるまでにしばらく時間がかかる。次回のエアー噴射時には組立体２の表面に沈降した塵埃が再び空中に舞い上げられるため、塵埃浮遊率が上昇するが、１回目の噴射の際に吸引手段６によりかなりの塵埃が吸引されているため、前回の噴射による塵埃数の増加に比べるとその増加率は少なくなる。このように、陽圧より高い圧力のエアー間欠噴射を繰り返すことにより塵埃浮遊率の値が徐々に減少し、組立体２の表面に付着した塵埃が除去される。

【００２５】粒径が２０μｍ以上の塵埃は粒径が２０μｍ未満の塵埃に比べて少ない繰り返し回数のエアー間欠噴射により塵埃浮遊率が減少する。粒径の大きな塵埃は、粒径の小さな塵埃に比べて沈降し易く、吸引手段６による空気の流れに乗りやすいため、吸引効率が高くなるからである。

【００２６】この図４から明らかなように、陽圧より高い圧力のエアー噴射を間欠的に行うことにより、連続的にエアーを噴射する従来の方法では除去が困難であった粒径２０μｍ未満の塵埃を効率よく取り除くことができる。

【００２７】以上、この発明の実施形態では、エアー噴射中及び休止中にかかわらず塵埃除去室４内のエアーを吸引手段６により連続的に吸引する構成としたが、エアー噴射の休止中にのみ吸引手段６による塵埃除去室４内のエアーを吸引するようにしてもよい。

【００２８】

【発明の効果】本発明に係る塵埃除去装置は、以上説明したように、エアー噴射手段によりエアーを組立体に間欠的に噴射させることにしたので、組立体から空中に舞い上げられた塵埃を、効率よく吸引手段による空気の流れに乗せることができることになり、この間欠的エアー噴射を繰り返すことにより、従来の連続的エアー噴射では除去が困難であった粒径２０μｍ未満の塵埃の除去が容易になるという効果を奏する。

【図面の簡単な説明】

【図１】本発明に係る塵埃除去装置の平面図である。

【図２】本発明に係る塵埃除去装置の側面図である。

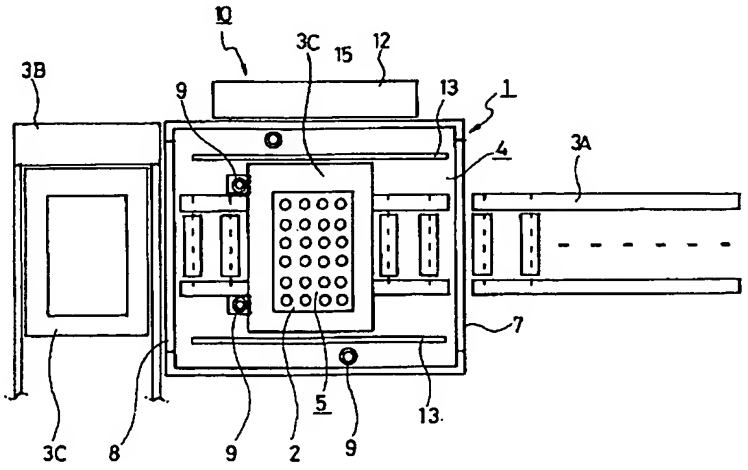
【図３】組立体の一例を示す図であって、組立工程における読み取り部の概略斜視図である。

【図４】所定圧力のエアーの間欠噴射に対する塵埃除去室内圧力及び塵埃除去室内塵埃浮遊率の関係を示す図である。

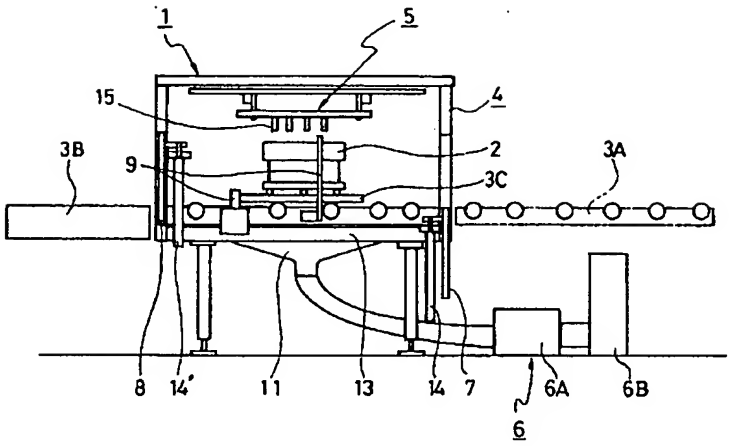
【符号の説明】

１…塵埃除去装置本体
２…組立体
４…塵埃除去室
５…エアー噴射手段
６…吸引手段
１０…外気吸入手段

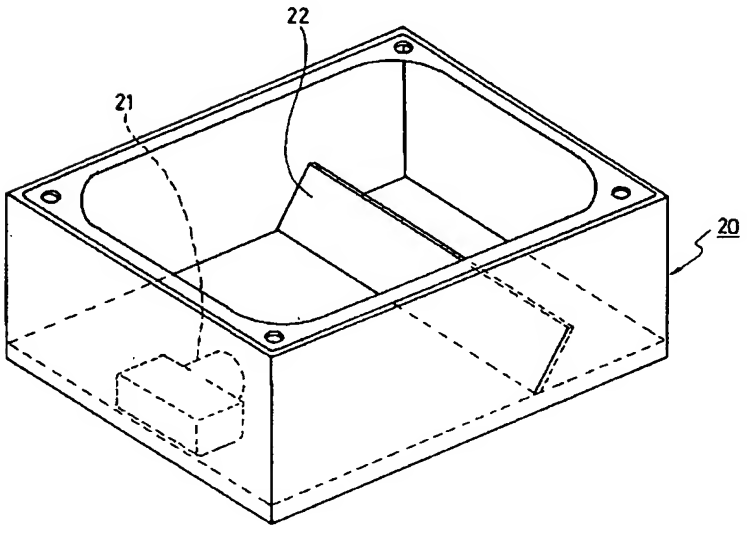
【図１】



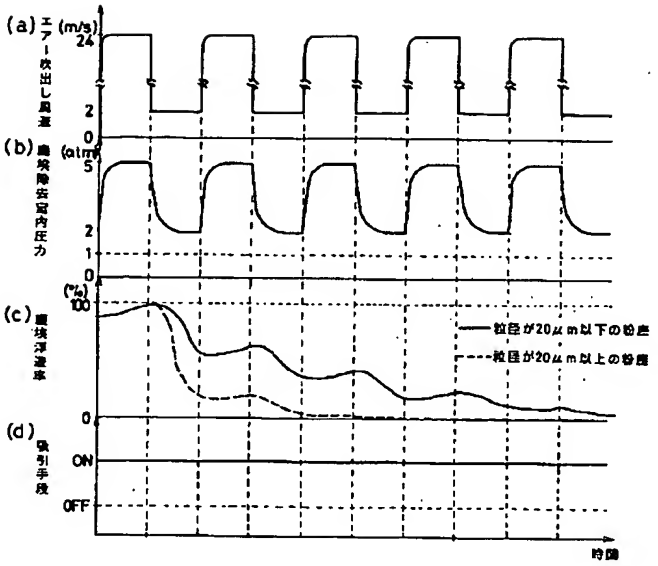
【図２】



【図３】



【図４】


(a) エアー吹出し風速
(m/s)
24
2
0
(b) 集塵除去室内圧力
(atm)
5
2
1
0
(c) 集塵浮遊率
(%)
100
0
粒径が20μm以下の粉塵
粒径が20μm以上の粉塵
(d) 吸引手段
ON
OFF
時間